Amendments to the Claims

This listing will replace all prior versions and listings of claims in the application:

Listing of the Claims

Claim 1. (currently amended) A closed air gap interconnect structure comprising:

at least two conductive interconnect lines separated by a lateral air gap, wherein at least one of said lines is connected to at least one conducting via, wherein each of said lines is supported underneath by a plurality of discrete regions made of a robust support dielectric separated by spaces such that the air gap is present not only between the lines but also substantially in the region beneath said lines, and said conductive lines being capped on top by a cap layer;

said cap layer comprising an array of pinched off holes.

Claim 2. (previously presented) The interconnect structure according to Claim 1, wherein said conductive interconnect lines and said conductive via comprise a conductive liner and a conductive fill material.

Claims 3-4. (canceled)

Claim 5. (previously presented) The interconnect structure according to Claim 1, wherein said regions of robust support dielectric form discrete support pillars that lie below said interconnect lines.

Claim 6. (previously presented) The interconnect according to Claim 1, wherein said holes are closed off with same or different dielectric barrier material.

Claim 7. (currently amended) A closed air gap interconnect structure comprising:

a substrate;

a first sacrificial dielectric coated on said substrate, said first coated sacrificial dielectric having therein a patterned set of discrete support regions formed by lithography and filled and planarized with a robust line support dielectric, said first sacrificial dielectric having therein contact via holes patterned by reactive ion etching;

a second sacrificial dielectric coated on said first sacrificial dielectric and said filled and planarized discrete support regions, said second sacrificial dielectric having lithographically patterned line trenches;

a conductive material filled into said line trenches and said via holes and planarized; and

a stencil with a regular array of holes on said filled line trenches and said second sacrificial dielectric;

wherein said first and second sacrificial dielectrics have been extracted through said holes to form air gaps located between said lines and substantially in the region beneath said lines not occupied by said vias ~~or~~ and said discrete support regions and

said regular array of holes have been closed off by depositing a cap dielectric thereby forming said closed air gap interconnect structure.

Claim 8. (currently amended) A closed air gap interconnect structure comprising:

a substrate;

a first sacrificial dielectric coated on said substrate, said first coated sacrificial dielectric having therein a patterned set of discrete support regions formed by lithography and filled and planarized with a robust line support dielectric, said first sacrificial dielectric having therein contact via holes patterned by reactive ion etching;

a second sacrificial dielectric and an optional hard mask layer disposed on said second sacrificial dielectric; said second sacrificial dielectric and said hard mask having lithographically patterned line trenches;

a conductive material filled into said line trenches and said via holes and planarized such that top of the filled conductive material is substantially coplanar with the top surface of said optional hard mask;

an optional first dielectric cap layer disposed on said hard mask layer; and

a sacrificial stencil with a regular array of holes on top of said cap layer, wherein said regular array of holes have been transferred into said first cap layer and said hard mask layer by a reactive ion etch process;

wherein said first and second sacrificial dielectrics have been extracted to form air gaps located between said lines and substantially in the region beneath said lines not occupied by said vias or said discrete support regions and a second dielectric cap has been deposited to pinch off the tops of said regular array of holes in said first cap

layer thereby closing off said regular array of holes forming said closed air gap interconnect structure;

said cap layer comprising an array of closed holes, there being a plurality of said holes disposed over said air gap.

Claim 9. (currently amended) A closed air gap interconnect structure comprising:

a substrate;

a first sacrificial dielectric coated on said substrate, said first coated sacrificial dielectric having therein a patterned set of discrete support regions by lithography and filled and planarized with a robust line support dielectric, said first sacrificial dielectric having therein contact via holes patterned by reactive ion etching;

a second sacrificial dielectric and an optional hard mask layer disposed on said second sacrificial dielectric coated on said first sacrificial dielectric, said second sacrificial dielectric and said hard mask having lithographically patterned line trenches;

an optional thin conformal dielectric passivation liner layer deposited on said contact via holes and said line trenches;

a conductive material filled into said line trenches and said via holes and planarized such that top of the filled conductive material is substantially coplanar with the top surface of said hard mask;

an optional first dielectric cap layer disposed on said hard mask layer; and

a sacrificial stencil with a regular array of holes on top of said first cap layer, wherein said regular array of holes have been transferred into said cap layer and said hard mask layer by a reactive ion etch process;

wherein said first and second sacrificial dielectrics have been extracted to form air gaps located between said lines and substantially in the region beneath said lines not occupied by said vias or said discrete support regions and an optional second dielectric cap has been deposited to pinch off the tops of said regular array of holes in said first cap layer thereby closing off said regular array of holes forming said closed air gap interconnect structure, said optional hard mask layer and said cap layer comprising an array of closed holes, there being a plurality of said holes disposed over said air gap.

Claim 10. (currently amended) A closed air gap interconnect structure comprising:

a substrate;

a first sacrificial dielectric coated on said substrate, said first coated sacrificial dielectric having therein a patterned set of discrete support regions by lithography and filled and planarized with a robust line support dielectric, said first sacrificial dielectric having therein contact via holes patterned by reactive ion etching;

a second sacrificial dielectric coated on said first sacrificial dielectric and said filled and planarized support regions, said second sacrificial dielectric having lithographically patterned line trenches;

a conductive material filled into said line trenches and said via holes and planarized;

an optional conductive material cap disposed on top surfaces of said conductive material filled into said trenches; and

a stencil with a regular array of holes on said line trenches and said second sacrificial dielectric and said optional conductive material cap;

wherein said first and second sacrificial dielectrics have been extracted to form air gaps located between said lines and substantially in the region beneath said lines not occupied by said vias ~~or~~ and said discrete support regions, and wherein said regular array of holes have been closed off by depositing a cap dielectric thereby forming said closed air gap interconnect structure.

Claim 11. (currently amended) A closed air gap interconnect structure comprising:

a substrate;

a first sacrificial dielectric coated on said substrate, said first coated sacrificial dielectric having therein a patterned set of discrete support regions by lithography and filled and planarized with a robust line support dielectric, said first sacrificial dielectric having therein contact via holes patterned by reactive ion etching;

a second sacrificial dielectric and an optional hard mask layer disposed on said second sacrificial dielectric coated on said first sacrificial dielectric, said second sacrificial dielectric and said hard mask having lithographically patterned line trenches;

a conductive material filled into said line trenches and said via holes and planarized such that top of the filled conductive material is substantially coplanar with the top surface of said hard mask;

an optional conductive material cap disposed on top surfaces of said conductive material filled into said trenches;

an optional first dielectric cap layer disposed on said hard mask layer and said conductive material cap; and

a sacrificial stencil with a regular array of holes on top of said first dielectric cap layer, wherein said regular array of holes have been transferred into said first dielectric layer and said hard mask layer by a reactive ion etch process;

wherein said first and second sacrificial dielectrics have been extracted to form air gaps located between said lines and substantially in the region beneath said lines not occupied by said vias ~~or~~ and said discrete support regions and a second dielectric cap has been deposited to pinch off the tops of said regular array of holes in said first cap layer thereby closing off said regular array of holes forming said closed air gap interconnect structure, said optional hard mask layer and said first cap layer comprising an array of closed holes, there being a plurality of said holes disposed over said air gap.

Claim 12. (currently amended) A closed air gap interconnect structure comprising:

a substrate;

a first sacrificial dielectric coated on said substrate, said first coated sacrificial dielectric having therein a patterned set of discrete support regions by lithography and filled and planarized with a robust line support dielectric, said first sacrificial dielectric having therein contact via holes patterned by reactive ion etching;

a second sacrificial dielectric and an optional hard mask layer disposed on said second sacrificial dielectric coated on said first sacrificial dielectric, said second sacrificial dielectric and said hard mask having lithographically patterned line trenches;

a thin conformal dielectric passivation liner layer deposited on said contact via holes and said line trenches;

a conductive material filled into said line trenches and said via holes and planarized such that top of the filled conductive material is substantially coplanar with

the top surface of said hard mask; and an optional conductive material cap disposed on top surfaces of said conductive material filled into said trenches;

an optional first dielectric cap layer disposed on said hard mask layer and said conductive material cap; and

a sacrificial stencil with a regular array of holes disposed on top of said first dielectric cap layer, wherein said regular array of holes have been transferred into said first dielectric layer and said hard mask layer by a reactive ion etch process;

wherein said first and second sacrificial dielectrics have been extracted to form air gaps located between said lines and substantially in the region beneath said lines not occupied by said vias or said discrete support regions and a second dielectric cap has been deposited to pinch off the tops of said regular array of holes in said first cap layer thereby closing off said regular array of holes forming said closed air gap interconnect structure, said optional hard mask layer and said cap layer comprising an array of closed holes, there being a plurality of said holes disposed over said air gap.

Claims 13-33. (canceled)

Claim 34. (previously presented) The interconnect structure according to Claim 1, wherein said regions of robust support dielectric form an array of pillars.

Claim 35. (canceled)